

High Temperature Phenomena in Cerium Dioxide Under Laser Heating

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Cerium dioxide is a very complicated substance for measuring radiative properties by a subsecond laser technique due to the sharp change of its reflection indicatrix at the melting point, low sublimation energy and, consequently, to its large saturated vapor pressure at high temperatures. The dense vapor phase formed above the investigated sample in laser heating actively interacts with the sample surface and the laser radiation and distorts the experimental results.

The developed polychromatic reflectometer with laser heating enabled one to discover the interesting phenomenon of the interaction of the vapor, liquid and solid phases of cerium dioxide under CO₂ laser irradiation. This phenomenon is exhibited in the form of the exothermic peak of the condensation on the cooling curves. Moreover the temperature level of this transition is regulated by experimental parameters.

The determination of the position of this “floating” phase transition on the temperature scale permits one to model the liquid-vapor and solid-vapor interactions to estimate the contribution of the dense vapor phase in the radiative properties of cerium dioxide at high temperatures, and to determine the parameters of the thermal radiative and conductive heat transfer between vapor and condensed phases of the high evaporation materials.